The Integrated Environmental Strategies (IES) Source Apportionment Study in Hyderabad, India

Background on the IES-India Program

The IES Program engages developing countries to help build support for integrated planning to reduce emissions of both global greenhouse gases (GHGs) and local air pollutants. The program promotes the analysis of and local support for implementing policy measures that result in multiple environmental, public health, and economic "co-benefits." The IES-India Program began in 2002 with an emission inventory of GHGs and ambient air pollutants, such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and particulate matter (PM), for the Hyderabad Urban Development Area (HUDA). Additionally, the IES team analyzed a number of mitigation options, including public transportation promotion and fuel conversion, vehicle inspection and maintenance, more stringent emission standards, and reductions in transportation and industrial dust pollution. Results of the study are available at <www.epa.gov/ies/india/index.htm>.

In 2003, the Supreme Court of India directed several states to produce action plans to combat rapidly increasing air pollution and related widespread respiratory disease. To provide additional scientific backing for the Hyderabad Action Plan, the Andhra Pradesh Pollution Control Board (APPCB) embarked on a source apportionment study in Hyderabad to examine the sources of PM identified in the original inventory and additional sources not included in the original inventory. APPCB, with support from the U.S. Environmental Protection Agency (EPA), provided in-country leadership and coordination for the project, including collecting and analyzing samples and providing financial resources. Other collaborating parties included the World Bank, the National Renewable Energy Laboratory (NREL), and the Desert Research Institute (DRI).

Objectives of the IES-India Source Apportionment Project

The four key objectives of the Hyderabad source apportionment project were to: 1) improve and validate the 2001 HUDA emission inventory by determining major sources of PM; 2) build capacity in sampling and analysis; 3) strengthen environmental management at the local level; and 4) provide data to support the reduction of both PM and GHG emissions through integrated strategies.

Findings

The November 2005–November 2006 study yielded six primary findings: 1) ambient PM levels increased since the 2001 inventory; 2) the majority of PM concentrations resulted from mobile sources; 3) pollution from diesel fuel increased from both mobile and industrial sources; 4) construction activities and vehicles increased pollution by re-suspending fine dust particles; 5) long-range pollution from industries outside the city increased from 2005 to 2006; and 6) waste burning represented a significant source of pollution. The results of the source apportionment study for PM are summarized in Table 1.

Recommendations

Based on the results of the *Co-benefits Analysis of the Hyderabad City Action Plan* included in this phase of work, APPCB recommended several intervention strategies as particularly effective in achieving co-control of PM and CO_2 in the city of Hyderabad. Table 2 lists the recommended strategies and shows the estimated reductions in PM_{10} and CO_2 by 2010 if these strategies are implemented.

The IES-India project team shared the results and recommendations of the India source apportionment study and the co-benefits analysis with local and national policymakers to encourage

Table 1. Overview of Source Apportionment Results (% of Total PM)

Source	% PM_{10*}	% $PM_{2.5**}$
Vehicles	48	49
Road Dust	33	5
Secondary Pollutants	8	5
Industry	6	5
Biomass Burning	5	5

* Particulate matter of 10 mm or less
** Particulate matter of 2.5 mm or less

the adoption of integrated co-benefits measures. Additional details on the source apportionment study can be found at <www.epa.gov/ies/india/apportionment.htm>. Information regarding the policymakers' workshop held in December 2007 are posted at <www.epa.gov/ies/india/apportionment_documents.htm>.

Table 2. Estimated Reductions in PM_{10} and CO_2 Through Co-Benefits Measures Compared to Business As Usual Projections for 2010

Form of Intervention	Tons of PM_{10}	% Reduction PM_{10}	Tons of CO_2	% Reduction CO_2
Convert all petrol-based three-wheelers to liquefied petroleum gas (LPG).	847	2.5	105,847	1.1
Promote public transport; expected reductions in kilometers traveled are 10% in cars, 20% in two-wheelers, and 20% in three-wheelers.	1,554	4.5	642,599	6.9
Replace 50% of the current diesel public transport bus fleet with cleaner diesel buses.	211	0.6	55,851	0.6
Inspect and maintain in-use vehicles to improve deterioration rates by 5%.	202	0.6	154,670	1.6
Double the stringency of emission standards for in-use diesel goods vehicles (light and heavy duty).	1,317	3.8	834,393	8.9
Promote wet sweeping to reduce silt loading on paved roads by 20% and increase moisture content on unpaved roads by 5%.	630	1.8	N/A	N/A
Improve dust collection efficiency at industrial sites by 25%.	2,105	6.1	N/A	N/A

For More Information

Visit the IES Web site at <www.epa.gov/ies> or e-mail <ies@epa.gov>.

Integrated Environmental Strategies

Photographs courtesy of National Renewable Energy Laboratory (NREL), Monisha Shah, and Adam Chambers

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